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UNCERTAINTIES

Is immobilisation required for toddler's fracture of the tibia?

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What you need to know

- There are no data or guidelines to suggest whether immobilisation is necessary for toddler's fracture
- We recommend that clinicians use their clinical judgment and engage families in shared decision making when deciding on immobilisation for toddler's fracture

What is toddler's fracture?

"Toddler's fracture" describes a non-displaced, isolated, spiral or oblique fracture of the tibia. There are no high quality studies that identify the incidence of these fractures, but orthopaedic and emergency department experience indicate they are common in

young children, typically occurring when they are ambulant (that is, toddlers) and between 9 months and 3 years old. They are usually the result of trivial injuries, such as a simple fall to the floor, though the mechanism is often not witnessed. They usually present with irritability and refusal to weight bear on the affected leg. Tenderness at the fracture site may be present, but it can be difficult to elicit.¹ The diagnosis is made using radiographs (fig 1), though clinical acumen is important as initial radiographs can be normal in up to two thirds of cases.² Indeed, both clinical and radiological signs are often unclear, making diagnosis challenging.³ Differentiating between accidental and non-accidental injuries is important in this age group, but we do not discuss this further in this paper.

This is one of a series of occasional articles that highlight areas of practice where management lacks convincing supporting evidence. You can read more about how to prepare and submit an Education article on our Instructions for Authors pages: <https://www.bmj.com/about-bmj/resources-authors/article-types>

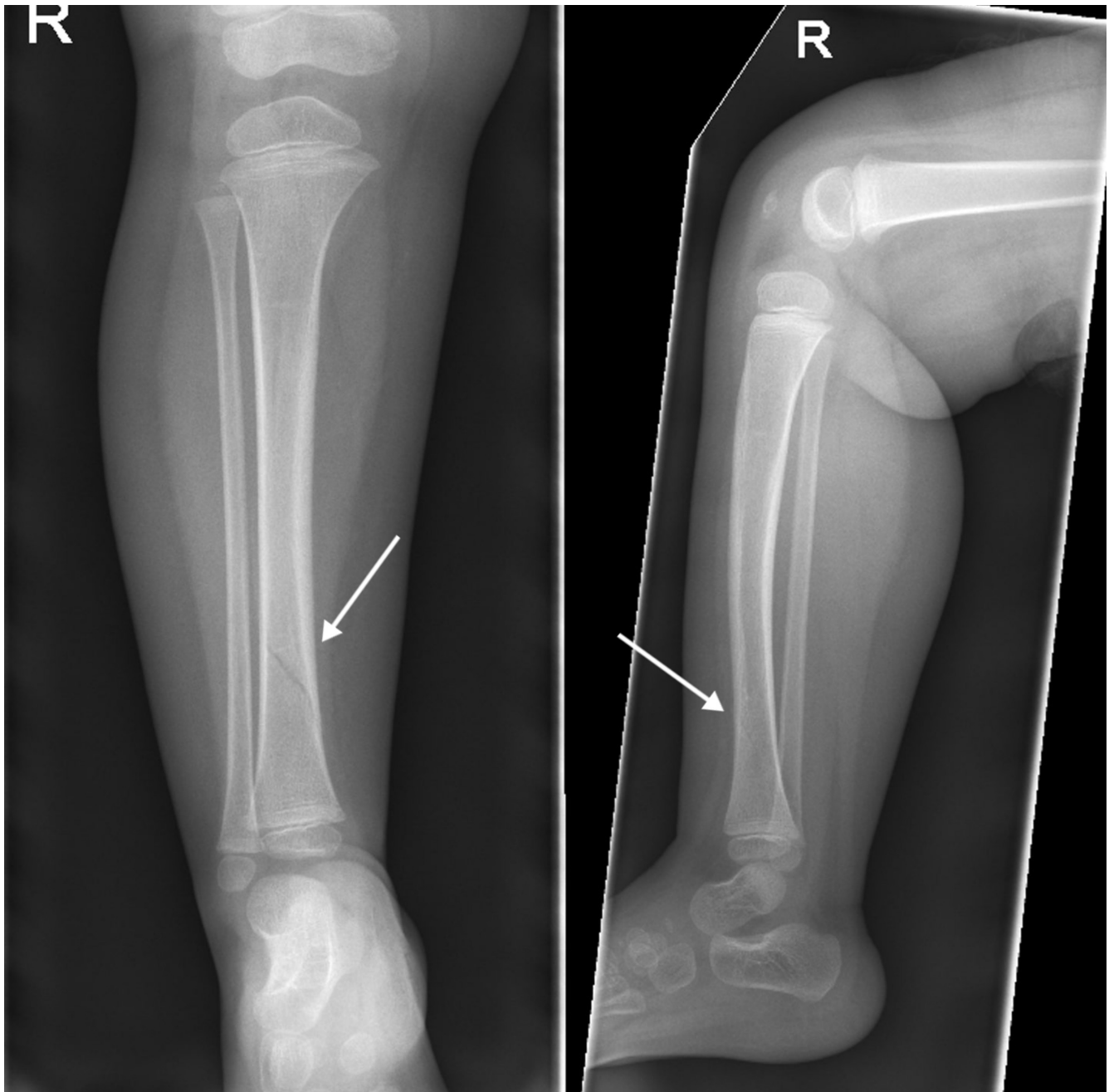


Fig 1 | (a) Plain anteroposterior (AP) radiograph of the tibia in a 2 year old showing a non-displaced spiral fracture through the tibia in the distal third of the diaphysis (arrow). There is no periosteal reaction. The findings are consistent with an acute toddler's fracture. (b) Lateral radiograph of the same injury, though the fracture line is more subtle on this view (arrow)

How does toddler's fracture differ from other common childhood fractures?

Toddler's fracture typically results from a twisting force, whereby the bone fails in a spiral pattern, but an intact periosteum (the strong lining around the bone) is maintained, which provides inherent stability and support to the bone. In comparison, a greenstick fracture occurs when the bone bends, causing a complete break in one cortex and a bend on the opposite side (akin to snapping a fresh twig from a tree), and a torus fracture occurs when immature bone crushes, resulting in a bulge in the bone.

What is the uncertainty?

Traditionally, treatment for toddler's fracture has been rigid immobilisation with a plaster cast, intended to protect the limb and reduce pain.⁴ Controlled ankle motion (CAM) boots, removable walking boots, and splints are other immobilisation options. However, given the stability provided by the intact periosteum, there is rapid healing and excellent outcome, and it is unclear whether any immobilisation is necessary. A 2018 Canada-wide survey on management strategies of toddler's fracture showed national variation,⁵ including rigid immobilisation with a cast,

incomplete-immobilisation with a splint, and no immobilisation with simple observation.

There is a longstanding doctrine of fracture immobilisation with a plaster cast, but complications (including pressure sores, skin injuries through plaster removal, and post-removal limb stiffness) mean this is not completely risk-free. Furthermore, the increased direct and indirect costs associated with immobilisation make less invasive approaches more appealing if they are deemed as effective, safe, and acceptable to clinicians and families.

There are currently no widely used guidelines for the management of toddler's fracture.

What is the evidence of uncertainty?

Search strategy

We searched MEDLINE through Pubmed using the terms "toddler*/toddler's" AND "fracture" to identify papers between 1991 and

2022. We also searched the Cochrane Library using the term "toddler's fracture." Manual searches of reference lists completed our evidence base.

In our search, we identified eight studies (table 1) that compared treatment approaches (that is, plaster immobilisation versus splint immobilisation or no immobilisation); in particular, where outcomes were achieved that matched those identified as being core outcomes for lower limb fractures in children by the CORE-Kids collaborative group¹⁴—including pain, return to physical activities, emotional wellbeing, complications, return to activities of daily living, mobility recovery, learning participation, evidence of deformity, and time to union.

Table 1 | Evidence of uncertainty summary: comparison of eight studies identified as comparing different treatment approaches

Study	Study type	Participants	Cohorts	Relevant outcomes and findings		Limitations
Llorente Pelayo et al 2020 ⁶	Retrospective case series	53 children in Spain, median age 2.04 years (IQR 1.4 - 2.7)	Immobilisation with rigid cast (n=43, 80.8%) Immobilised with "splint" or not at all (n=10, 19.2%)	Complications	Higher frequency in rigid cast group (P=0.006): one fracture displacement, pressure ulcers	Retrospective. Incomplete follow-up. No details of "splint" used
				Median time to weight bearing	No significant difference	
Bauer et al 2019 ⁷	Retrospective case series	192 children in US, mean age 2.0 years (95% CI 1.9 to 2.1)	Immobilisation with long leg cast (n=53, 28%) Immobilisation with short leg cast (n=83, 43%) Immobilisation with removable walking boot (n=46, 24%) Long leg splint (n=3, 2%) No immobilisation (n=7, 4%)	Time to weight bearing	Fastest time to weight bear in removable walking boot group. Significant difference compared with short leg cast (2.5 v 2.8 weeks, P=0.040)	Retrospective. Variable follow-up timings
Leffler et al 2018 ⁸	Retrospective case series	85 children in US, mean age 23.4 months (range 8-55)	Immobilisation with long leg cast (n=19, 22%) Immobilisation with short leg cast (n=59, 69%) No immobilisation (n=7, 8%)	Length of immobilisation required	No difference between long and short leg cast (24 v 21 days, no P value)	Retrospective. Few patients in no immobilisation cohort. Varying follow-up times
				Time to weight bearing	Fastest time to weight bear in no immobilisation cohort (10 days v 19 days in long leg cast, P=0.027)	
				Time to radiographic union	No difference.	
				Fracture displacement	One occurrence in short leg cast group	
				Cast complications	11 occurrences, including loose fit, initial casting in wrong position, pressure sores, and soiling of cast.	
Ferrier et al 2020 ⁹	Retrospective case series	240 children in Australia, mean age 24.0 months (SD 8.7)	Immobilisation with back slab or cast (n=104, 43%) No immobilisation (n=136, 57%)	Complications	More complications with cast immobilisation (P<0.001): skin complications, cast breakdown, and pain No immobilisation: pain and persistent limp	Retrospective. Varying or incomplete follow-up times. No multivariate analysis on outcomes
				Re-presentation to ED	More frequent with immobilisation (RR 2.62 (95% CI 1.23 to 5.58))	
Schuh et al 2016 ¹⁰	Retrospective case series	75 children in US, mean age 21.3 months (SD 6.5)	Immobilisation with removable walking boot (n=18, 24%) Immobilisation with splint or cast (n=50, 66.7%) No immobilisation (n=7, 9.3%)	No of orthopaedic follow-up visits	Fewer for immobilisation with removable walking boot or not at all (P<0.001)	Retrospective. Low numbers in removable walking boot and no immobilisation cohorts. Includes only radiologically confirmed fracture. Varying or incomplete follow-up
				Total duration of immobilisation	Reduced duration of immobilisation when initially managed with no immobilisation versus management with removable walking boot, splint or cast (P<0.001)	
				Return to ED after initial treatment	No difference	
				Skin breakdown	No difference	
Adamich et al 2017 ¹¹	Retrospective case series	184 children in Canada, mean age 2.0 years (range 0.2-3.9, SD 0.8)	Initial immobilisation with removable walking boot or plaster cast (n=159, 86.5%) No initial immobilisation (n=12, 6.5%) Unknown (n=13, 7%)	Complications	No difference (none identified)	Retrospective. Includes only radiologically confirmed fracture. No comparison of outcomes between cohorts. Unclear "no immobilisation" definition. Varying or incomplete follow-up.
				Radiographic or clinical union either confirmed or presumed at discharge	No difference (all fractures healed)	

Table 1 | Evidence of uncertainty summary: comparison of eight studies identified as comparing different treatment approaches (Continued)

Study	Study type	Participants	Cohorts	Relevant outcomes and findings		Limitations
Fox et al 2022 ¹²	Single centre RCT with a preference cohort arm	44 children in US, median age immobilised 2.0 years (IQR 1.0), median age not immobilised 1.8 years (IQR 0.8)	Immobilisation with long leg cast (n=14, 32%) No immobilisation (n=30, 68%)	Complications	Fewer with no immobilisation (P=0.010). Examples in immobilisation group: wet cast, poor tolerance	Single centre. No blinding. Low enrollment rates after 1 year of the study running led to creation of a preference arm. Of the 44 patients enrolled, only 10 were randomised
				Additional visits	No difference	
				Modified OxAFAQ-C questionnaire at 4 and 8 weeks	No difference	
				Parental perception of treatment discomfort*	No difference	
				Parental perception of whether child has returned to normal walking*	Improved outcome in the no immobilisation group at 4 and 8 weeks	
				Parent likelihood of choosing the same treatment again*	Higher likelihood in the no immobilisation group at 4 and 8 weeks	
Bradman et al 2022 ¹³	Single centre RCT	81 children in Australia, median age in removable walking boot 2 years (IQR 1.5-2.3), median age in above knee plaster of Paris immobilisation (AK-POP) 2 years (IQR 1.7-2.8)	Immobilisation with removable walking boot (n=41, 51%) Immobilisation with AK-POP (n=40, 49%)	Personal care (primary outcome, measured using modified care and comfort questionnaire)	Improved outcome in removable walking boot group at day 2, days 7-10, and 4-6 weeks (P<0.001)	Single centre. No blinding. Misalignment of power calculation method and final analysis
				Pain (visual-analogue scale)	No difference.	
				Weight bearing status	Improved weight bearing at days 7-10 with removable walking boot versus AK-POP (77.5% v 53.8%, P=0.027). No significant difference found at 4-6 weeks	
				Complications	Two occurrences in the removable walking boot group: fracture widening and increasing pain	

IQR=interquartile range. SD=standard deviation. ED=emergency department. RR=relative risk. OxAFAQ-C=Oxford Ankle and Foot Questionnaires for Children.

* Recorded on family satisfaction surveys.

The evidence consists primarily of retrospective case series and only two prospective studies. The quality of the evidence is low, with no blinding of assessors and imprecise estimates of effect sizes due to small sample sizes. Only one prospective non-randomised study compared immobilisation versus no immobilisation, with an apparently strong parental preference for no immobilisation.¹² This study showed no difference in the outcomes of pain, function, time to return to normal function, or time to union between the interventions. The risk of complications seemed to be lower in the no immobilisation group, with the avoidance of plaster cast immobilisation overcoming the risk of skin complications. There were treatment failures in the no immobilisation group, defined by the need to switch to rigid immobilisation, but these were at parental request rather than a specific clinical need.

The results of all studies within our search suggested that no immobilisation (or at least immobilisation with removable walking boot) seems to be as effective, regarding the items within the core outcome set, as immobilisation with a plaster cast, though it may have fewer complications. The quality of the studies and the lack of transparency in reporting precludes definitive conclusions. Given the non-randomised nature of most studies, selection bias is likely to be a concern, with only the most minor fractures likely to have been treated without immobilisation. Furthermore, little evidence

underpins the safety of this approach, and the acceptability of this strategy among families is inconclusive. A randomised controlled trial of an injury with similar severity in children—torus fractures of the upper limb—showed that no-immobilisation was acceptable to families.¹⁵

Is ongoing research likely to provide relevant evidence?

We searched the ISRCTN and the ClinicalTrials.gov websites with the keywords “toddler’s fracture.” This revealed two studies comparing treatment interventions. The first, currently open and recruiting in Canada, is a randomised controlled trial (RCT) comparing two different immobilisation techniques: plaster cast versus removable walking boot (Clinicaltrials.gov identifier: NCT03971448). The second is an unpublished RCT in the United States that randomised between plaster immobilisation and no immobilisation (Clinicaltrials.gov identifier NCT01926795). This study completed in 2015 and recruited 21 patients, though results are not yet available. There are no ongoing registered studies comparing immobilisation with observation in children with toddler’s fracture, and therefore no ongoing research that is likely to provide an answer to whether immobilisation is required.

Recommendation for further research

We recommend a high quality, pragmatic, multicentre randomised controlled trial in emergency departments comparing current methods of immobilisation and follow-up with no immobilisation and immediate discharge. We recommend that outcomes should include the core outcome set formulated by the CORE-Kids collaborative group,¹⁴ particularly pain, time to weight bear, and complications.

What should we do in light of the uncertainty?

Most cases of toddler's fracture are currently treated with immobilisation, and, in the absence of high quality RCT evidence, clinicians may be hesitant to deviate too far from this standard of practice. A removable walking boot, rather than plaster immobilisation (guided by evidence from one small, randomised trial) may be a reasonable compromise for many clinicians and parents until robust evidence emerges of the safety and acceptability of no immobilisation.¹³

Make shared decisions with families—particularly regarding patient acceptability of immobilisation techniques (for example, is there a history of skin concerns?) and any barriers to follow-up (such as in relation to work absences, availability of transportation, and costs incurred).

If the decision is not to apply a cast, children can be observed and allowed to return to their regular activities as the discomfort settles.

At discharge, offer clear advice about pain management, how to recognise complications, and who to contact in the event of concern.

Regardless of initial treatment, clinicians and parents can be reassured that toddler's fractures heal well,^{11 16} with most patients ambulating by four weeks.⁷

Information for parents to support shared decision making

- Children typically make a full recovery by four weeks, with no serious problems, including no notable risk of repeat injury—evidence suggests that speed of recovery is not affected by whether the leg is immobilised in a plaster cast or splint, or if it is not immobilised
- Further research is needed to show if one form of treatment is better than the other for fracture healing or pain control
- Personal preference and practical issues may help guide the treatment plan

How patients were involved in this article

A parent coauthor contributed to the development of this article during the writing process and has reviewed the final article. A patient review was arranged by *The BMJ*, and feedback from it was incorporated into the article, particularly around safety-netting and parental advice at discharge.

Education into practice

- What do you include in your shared decision making discussions with parents about toddler's fracture?

Provenance and peer review: Commissioned; externally peer reviewed.

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